

A NEW SPECIES OF *NANNOSTOMUS*
(TELEOSTEI: LEBIASINIDAE) FROM NEAR
PUERTO AYACUCHO, RÍO ORINOCO
DRAINAGE, VENEZUELA

Justa M. Fernandez and Stanley H. Weitzman

Abstract. — *Nannostomus anduzei* is described as a new, miniature species of the characiform family Lebiasinidae from near the Río Orinoco, north of Puerto Ayacucho, Territorio Federal Amazonas. This species is distinguished from all other species of *Nannostomus* by its tiny adult size (to 16.2 mm SL), several reduced structures, and a distinctive live color pattern. Although the new fish is clearly a species of *Nannostomus*, its relationships among the other species are obscure.

The new species of *Nannostomus* described below brings the number of known species to 15, nearly half of them having been described in the last 30 years. The relationships of the species of *Nannostomus* have been discussed by Géry (1977: 127-135) and Weitzman and Weitzman (1982:416-419). The species have been described in some detail by Weitzman (1966), Weitzman and Cobb (1975), and Weitzman (1978). Weitzman and Weitzman (1982: 417) remark that with only a few exceptions they were unable to accept cladistic hypotheses of relationships among *Nannostomus* species based on 40 morphological characters extracted from Weitzman (1966: 8-53), Weitzman and Cobb (1975:6, 9-11, 25-33), and Weitzman (1978:2, 3, 7-9). They found a high degree of homoplasy and character lability causing them to distrust most phylogenetic hypotheses of relationships. Géry (1977:127-135), apparently partly based on Weitzman (1966:4-9) and Hoedeman (1950:22), recognized two genera and one subgenus of nannostomin lebiasinids. However, Weitzman and Cobb (1975:3-7) and Weitzman (1978:7-9) discuss why most of the morphological characters used by Géry (1977), Weitzman (1966) and Hoedeman (1950) are of dubious for generic diagnosis. Interestingly,

Weitzman and Weitzman (1982:419) and Géry (1977:131) accepted different hypotheses of relationships among certain species of *Nannostomus*. Géry's hypotheses were based on unpublished karyotypic information sent to him by J. J. Scheel. The karyotypic information was not cladistically analyzed and appears to have the same limitations discussed by Weitzman and Fink (1983:394, 395) for similar data recorded for species of *Paracheirodon* Géry. We do not discuss here the many problems of relationships among the species and populations of *Nannostomus*. We only summarize current opinions in order to demonstrate that a satisfactory study of the phylogenetic relationships of the species of *Nannostomus* is lacking.

Methods and Materials

Data are recorded as described in Weitzman (1966:3-6). All measurements other than standard length (SL) are expressed as a percentage of SL except subunits of the head which are recorded as a percentage of head length unless otherwise noted. Total vertebral counts, taken from radiographs and from cleared and Alizarin red and Alcian blue stained specimens include all vertebrae of the Weberian apparatus counted



Fig. 1. *Nannostomus anduzei*, new species, holotype, male, MBUCV-V-15.141, SL 13.1 mm, Laguna Provincial, about 20 km north of Puerto Ayacucho, Departamento de Ature, Territorio Federal de Amazonas, Venezuela, 1 Dec 1984.

separately. The fused $PU_1 + U_1$ of the caudal skeleton is counted as a single vertebra. In the text and tables, the count or morphometric character given first is for the holotype; the next series of figures is the range for the sample cited. This is given separately in parentheses for each population sample. These figures are followed by a mean (\bar{x}) for each population sample. Specimens examined for this study are deposited in the Academy of Natural Sciences, Philadelphia (ANSP); American Museum of Natural History, New York (AMNH); the British Museum (Natural History) (BMNH); the California Academy of Sciences, San Francisco (CAS); Ministerio de Agricultura y Cria, Puerto Ayacucho, Venezuela (MAC-PAY); Museo de Biologia, Instituto de Zoologia, Universidad Central de Venezuela (MBUCV-V); Museu de Zoologia da Universidade de São Paulo (MZUSP); the Museum of Zoology, University of Michigan (UMMZ); and National Museum of Natural History, Smithsonian Institution (USNM).

Nannostomus anduzei, new species
Figs. 1–7, Table 1

Holotype.—MBUCV-V-15.141, male, SL 13.1 mm, Venezuela, Territorio Federal de

Amazonas, Departamento de Ature, Laguna Provincial, approximately 20 km north of Puerto Ayacucho, about 5°50'N, 67°30'W, 1 Dec 1984, R. P. Vari, A. Machado, C. Ferraris, O. Castillo and J. Fernandez.

Paratypes.—102, USNM 277697, males 31, SL 11.1–13.4 and females 71, SL 11.6–12.9 mm; 4, AMNH 57010, SL 12.4–12.6 mm; 4, ANSP 157486, SL 11.2–12.7 mm; 4, BMNH 1985.12.31:4–8, SL 11.2–13.0 mm; 4, CAS 57819, SL 11.8–12.7 mm; 4, MZUSP 35433, SL 11, 8–12.2 mm; 4, UMMZ 213449, SL 11.4–13.0 mm; all with same collection data as holotype.—35, USNM 244696, males 18, SL 11.1–13.5 and females 25, SL 11.1–14.9 mm, Venezuela, Territorio Federal de Amazonas, Departamento de Ature, Caño Provincial, approximately 20 km north of Puerto Ayacucho, about 5°50'N, 67°30'W, 1 Dec 1984, R. Vari, A. Machado, C. Ferraris, O. Castillo, J. Fernandez.—6, USNM 277695, (cleared and stained with Alizarin red and Alcian blue), SL 12.8–14.5 mm; AMNH 57009, males 4, SL 11.5–14.0 and females 11, SL 9.8–13.9 mm; preceding two lots with same collection data as USNM 277696. MBUCV-V-15.601, males 8, SL 12.7–16.0 and females 4, SL 11.6–13.6 mm; MAC-PAY-0389, males 7, SL 12.9–14.9 and females 3, SL



Fig. 2. *Nannostomus anduzei*, new species, paratype, female, USNM 277697, SL 11.9 mm, Laguna Provincial, about 20 km north of Puerto Ayacucho, Departamento de Ature, Territorio Federal de Amazonas, Venezuela, 1 Dec 1984.

11.6–13.3 mm, both with same locality data as USNM 177696 above, collected 19 May 1981, E. Armas, J. Fernandez. — 30 of which 14 cleared and stained, MBUCV-V-15.600, SL 9.6–16.2 mm; MAC-PAY-1.200, males 5, SL 11.3–15.4 and females 8, SL 10.2–15.7 mm, same locality data as USNM 277696 above, collected 18 Jun 1986, J. Fernandez.

Diagnosis. — Distinguished from all other species of *Nannostomus* by having a pelvic-fin ray count of ii-6 rather than ii-7, by a principal caudal-fin ray count of 9/8 rather

than 10/9, and by having 4 premaxillary teeth rather than at least 5 in adults (up to 8 in some species of *Nannostomus*). All these characters appear to be progenic, and associated with small size of this species. *Nannostomus anduzei* is smallest known species of *Nannostomus*, sexually adult specimens maturing about SL 11.0 mm and reaching to at least SL 16.2 mm. *Nannostomus minimus* Eigenmann, next larger known species, matures at about SL 16.0 mm and known to reach SL 22.8 mm. *Nannostomus marginatus* Eigenmann matures at about 17.0

Table 1.—Morphometrics of *Nannostomus anduzei* arranged by sex. Standard length is in millimeters. First group of measurements expressed as percentages of standard length, second group as percentages of head length. n = 26 in all cases.

	Holotype	Males		Females	
		Range	\bar{x}	Range	\bar{x}
Standard length	13.1	11.2–13.4	12.5	11.5–13.5	12.3
Depth at dorsal-fin origin	28.2	23.6–28.3	25.3	25.4–29.5	27.4
Snout to dorsal-fin origin	55.7	51.6–58.9	56.5	52.9–58.9	55.7
Snout to anal-fin origin	74.0	71.2–76.4	73.5	74.2–78.6	76.6
Caudal peduncle depth	12.6	10.3–13.4	11.7	10.3–12.7	11.4
Anal-fin lobe length	26.0	20.3–29.2	24.8	14.8–17.8	16.2
Bony head length	28.2	24.5–28.4	27.1	24.1–27.4	25.8
Horizontal eye diameter	36.5	34.4–41.9	37.9	36.7–42.5	39.1
Snout length	24.3	20.8–25.4	23.9	20.9–24.6	23.0
Interorbital width	40.5	35.3–45.0	41.8	37.6–47.6	42.2

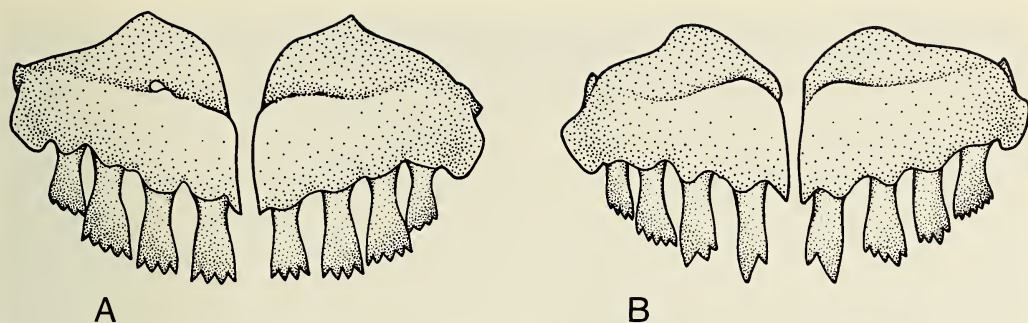


Fig. 3. *Nannostomus anduzei*, new species, paratypes, USNM 277695; anterior view of premaxillary bones and teeth of both sides of both specimens; A, male SL 12.0 mm; B, male SL 13.0 mm.

mm and reaches about 23.0 mm SL. All other species mature at over SL 20 to 30 mm depending upon species. Males of *Nannostomus anduzei* with distinctive life color pattern, having an intensely red caudal peduncle and anal fin. Some other species of *Nannostomus* with red on anal fin, usually as a spot or bar, never as an intense color covering nearly entire fin and part of adjacent body (except for an undescribed *Nannostomus* species of much larger adult body length). Some species of *Nannostomus*, for example, *N. marginatus*, have some populations with males having a red bar or blotch on middle rays of caudal fin and this color may extend onto base of caudal peduncle. It never covers almost entire caudal peduncle as in *N. anduzei*.

Description.—See Table 1 for morphometric values. Body elongate, robust, somewhat compressed in region of caudal peduncle. Greatest body depth at origin of dorsal fin or somewhat anterior to that point. Profile of body as in Figs. 1, 2. Head bluntly conic anteriorly, mouth terminal, snout blunt. Eyes large, horizontal diameter exceeds snout length. Interorbital width about equal to or exceeding horizontal eye diameter.

Premaxilla with single row of 4 teeth in 30 specimens. See Figs. 3, 4. Anterior tooth bicuspid to quadricuspid. This tooth occasionally unicuspid, often bicuspid, especially in males. In males this tooth infre-

quently tri- or quadricuspid but in females usually quadricuspid, rarely tricuspid and no female with this tooth unicuspid or bicuspid. In females cusps usually equal in size, while in males cusps usually subequal with lateral cusps being larger, especially in teeth with 2 or 3 cusps. When 4 cusps present in females, cusps subequal. Maxilla with one tooth in 30 specimens, usually bearing 3 cusps, rarely 1 or 2, cusps subequal or center cusp somewhat larger than others. Maxillary tooth of females occasionally with up to 6 relatively equal cusps. See Figure 4. Dentary with 4–5 (almost always 5) teeth in outer row, each tooth bearing about 3–6 more or less subequal cusps. Anterior teeth of dentary usually with central cusps largest (see Fig. 3). Inner row of dentary teeth simple, conic, 0–3 in 6 cleared and stained examples; some specimens have cusps on teeth in both jaws nearly worn away.

Gill rakers 8–9 + 13–14, no more than 22 total rakers in any of 6 cleared and stained specimens. Branchiostegal rays 3. First and second infraorbitals without complete laterosensory tube. Infraorbital 3 without closed bony tube, ossification often reduced. Remaining infraorbitals appear not to be ossified.

Dorsal-fin rays ii-8, $n = 31$; pectoral-fin rays i-7, $n = 31$; pelvic-fin rays i-6, $n = 31$; anal-fin rays ii-9, $n = 31$; and principal caudal-fin rays 9/7, $n = 31$. Adipose fin absent in all specimens.

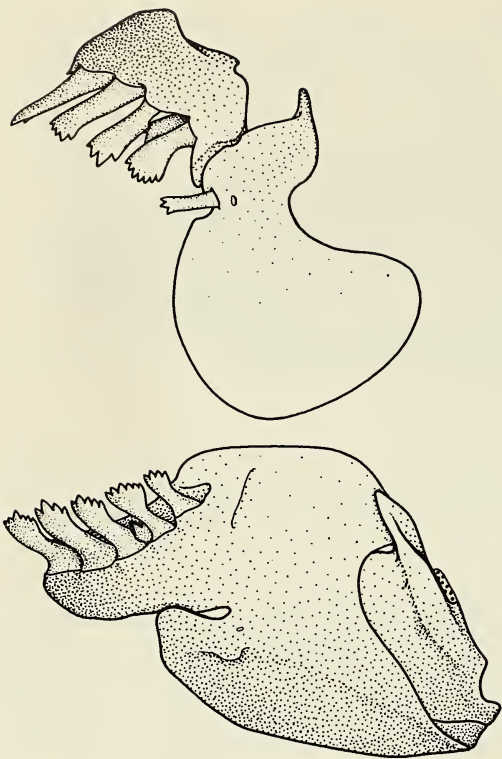


Fig. 4. *Nannostomus anduzei*, new species, paratype, USNM 277695, male SL 13.0 mm. Lateral view of jaws, left side.

Scales of third horizontal scale series ventral to dorsal fin having anterior field with 2, sometimes 3, radial grooves. Scale rows between origin of dorsal and pelvic fins 7 in 30 specimens. Predorsal scales 7–9, $\bar{x} = 8.0$, $n = 24$. Lateral-line scales 0–1, usually 0. Scales in lateral series 21–22, $\bar{x} = 21.1$, $n = 31$. Scale rows around caudal peduncle 11 in 30 specimens. Total vertebrae 31–33, $\bar{x} = 31.9$, $n = 95$.

Color in alcohol.—Dorsal surface of head dark to light brown, more or less evenly covered with dark to light brown chromatophores. Top of head posterior to eyes usually darker than region between and anterior to eyes. Dorsal surface of body dorsal to narrow secondary horizontal stripe pale to medium brown. No median predorsal stripe or fourth horizontal stripe as in *Nannostomus eques* Steindachner or *Nanno-*

stomus britskii Weitzman. Primary horizontal stripe extending from snout tip and lower jaw posteriorly across first (anterior) infraorbital bone, sometimes evident on eye, across preoperculum and operculum to beginning of fourth horizontal scale row at cleithrum and supracleithrum. Stripe on operculum may be weak, especially in males, to dark and very obvious, especially in females. On body primary horizontal stripe, when obvious, begins under fleshy opercular flap and extends along fourth horizontal scale row, terminating at base of ventral caudal-fin lobe in many specimens or extending posteriorly onto fin rays of ventral caudal-fin lobe in other specimens, especially large females. Primary horizontal stripe hardly perceptible to apparently absent on body in males, dark chromatophores constituting primary stripe often indistinguishable from those of body sides. Dark chromatophores in primary stripe area somewhat larger and sometimes organized into a weakly perceptible stripe, especially in larger males. Females with primary stripe on body much more evident, dark chromatophores being more numerous, larger and darker in most specimens (especially large females) than in males. Chromatophores sometimes very dense and dark in central area of distal field of scales of fourth horizontal row counted ventrally from dorsal-fin origin. Secondary dark horizontal stripe narrow, sometimes quite clearly defined, especially in large, darkly pigmented females. This stripe begins at area just dorsal to opercular bone (where it joins head dorsally), and extends posteriorly across middle of third horizontal scale row, ending at caudal-fin base. A narrow pale stripe present between primary and secondary horizontal stripes. Oblique bands appear absent. Well developed tertiary horizontal stripe appears absent although organized dark chromatophores occur around anus and extend anteriorly as an organized stripe to near pelvic-fin base. These more evident in darkly colored females than in all males. Sides ventral to primary horizontal stripe

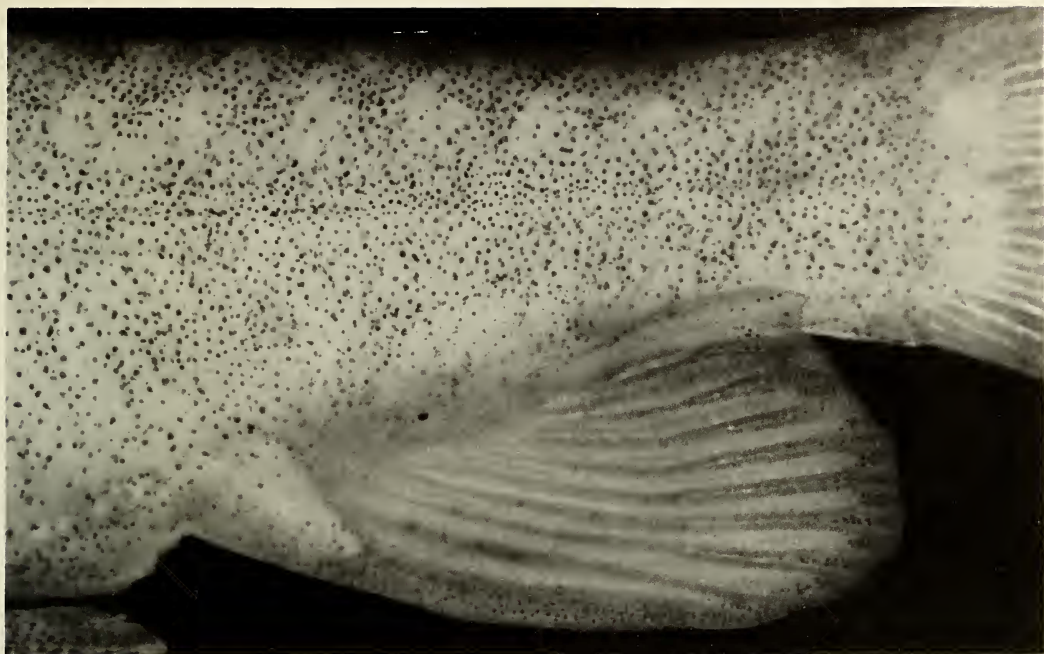


Fig. 5. *Nannostomus anduzei*, new species, paratype, USNM 277697, male SL 13.2 mm. Lateral view, left side of anal fin and associated body region.

covered with small, scattered dark chromatophores in males, but almost devoid of chromatophores in females. Except for ventral lobe caudal fin described above, fins of females with only small chromatophores scattered along fin ray margins. Dorsal and pelvic fins of males with many dark chromatophores on fin membranes between rays. Anal fin also darkly colored in males with chromatophores being somewhat less dense than on dorsal and pelvic fin. Anterior border of anal fin with many scattered dark chromatophores. Other fins essentially like those of females.

Color in life.—Color recorded here from Ektachrome slides of freshly preserved male and female paratypes taken at time of capture at type locality and Caño Provincial. Male specimens in formalin retained much red pigment until placed in alcohol at USNM. Entire anal fin of male a deep blood red except anterior border which bears dark chromatophores, forming elongate black border in life. Body adjacent to anal fin also red. Posterior half of caudal peduncle and

anterior half of caudal fin covered with same deep red pigment as anal fin. Body sides appear to reflect pale blue and some of this color appears on black pelvic fins. Distal portions of dorsal fin and entire distal half of anterior 3–4 rays of dorsal fin black. Dorsal and pelvic fins hyaline. Dark chromatophores on interradiial membranes provide fins with dusky appearance. Head and body pale green or greenish yellow. Scales of back bordered with dark pigment giving back a reticulate pattern. Head also yellow-green. Primary horizontal dark stripe poorly-developed in males, black and well-developed in females, extending to caudal-fin base. Females with all fins hyaline, pale yellow.

Sexual dimorphism.—*Nannostomus anduzei* is sexually dimorphic in live and preserved color pattern, to a certain degree in the premaxillary teeth, relative size and structure of the anal fin, and in the form of the tissues around the anus. Differences between males and females are given in preserved and live color patterns described above in the sections on color pattern. Brief-

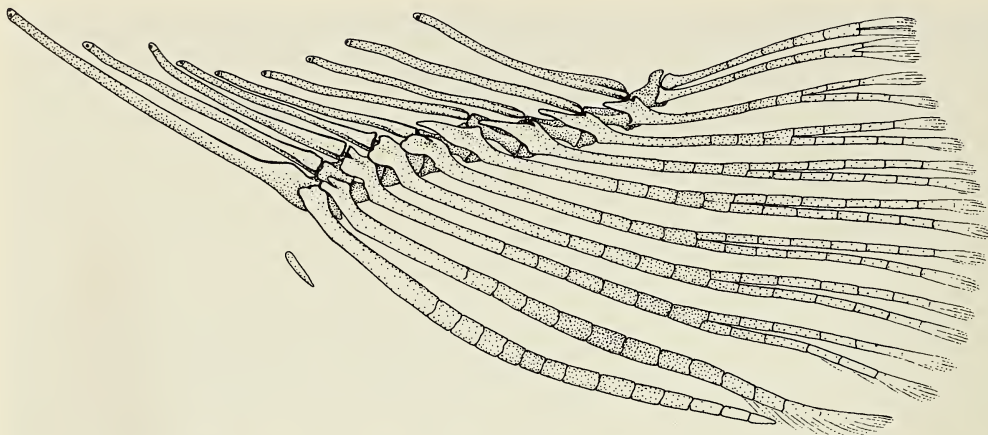


Fig. 6. *Nannostomus anduzei*, new species, paratype, USNM 277695, male SL 12.8 mm. Lateral view, left side of skeleton of anal fin. Fin rays not thickened.

ly and most prominently, males have a deep red anal fin and caudal peduncle (females lack the deep red) and the females often have a more prominent primary stripe, both in live and preserved specimens.

The anal fin of the male has more elongate rays. See the anal-fin lobe lengths of males and females in Table 1 and compare Figs. 1 and 2. Also see Figs. 5, 6, and 7. Many species of *Nannostomus* have modified anal-fin rays in the male. See Weitzman (1966), figs. 1, 2, 4, 5, 6, and 10 and Weitzman and Cobb (1975), figs. 3, 5, 18, and 21 for illustrations of the anal fins of males of species of *Nannostomus* with notably modified fins. The anal fin of male *Nannostomus digrammus* Fowler are the most modified of all known species of *Nannostomus* (see Weitzman 1966, fig. 6). The anal fin of male *Nannostomus anduzei* is not as derived as that of *Nannostomus digrammus*. Weitzman (1966:4, 24–25) briefly discussed the modified anal fins in males of species of *Nannostomus* and pointed out that derived muscles are present which deform anal fin into a cup-shaped structure that surrounds female's vent during spawning. Undoubtedly *Nannostomus anduzei* undergoes a similar spawning procedure and in Fig. 5 hypertrophied muscle tissue in the form of a large cone-shaped swelling is visible at the

anterior base of the anal fin. Enlarged muscle tissue also occurs at the posterior base of the anal fin but it is much smaller and not as easily visible. *Nannostomus anduzei* sometimes has the anterior anal-fin rays somewhat thickened (Fig. 7), but often not thickened (Fig. 6), especially in smaller males.

Comparison of Figs. 1 and 2 shows the differences in the vent size between males and females of *Nannostomus anduzei*. The large vent in this species may be a function of large egg size relative to the tiny size of the female.

Relationships.—The new species fits nearly all the characters diagnosed for *Nannostomus* by Weitzman (1966:9) and as modified by Weitzman and Cobb (1975:3–6). The diagnosis of the subtribe Nannostomina by Weitzman (1964:150–151) currently also provides a diagnosis for *Nannostomus*. The new species does not alter that diagnosis except for the number of cusps on the anterior premaxillary teeth, as few as two rather than as few as three. *Nannostomus anduzei*, being a very small species, is distinguished from all other *Nannostomus* species by a series of reductive characters noted above in the diagnosis.

The relationships of this species to other species of *Nannostomus* are not clear. It is

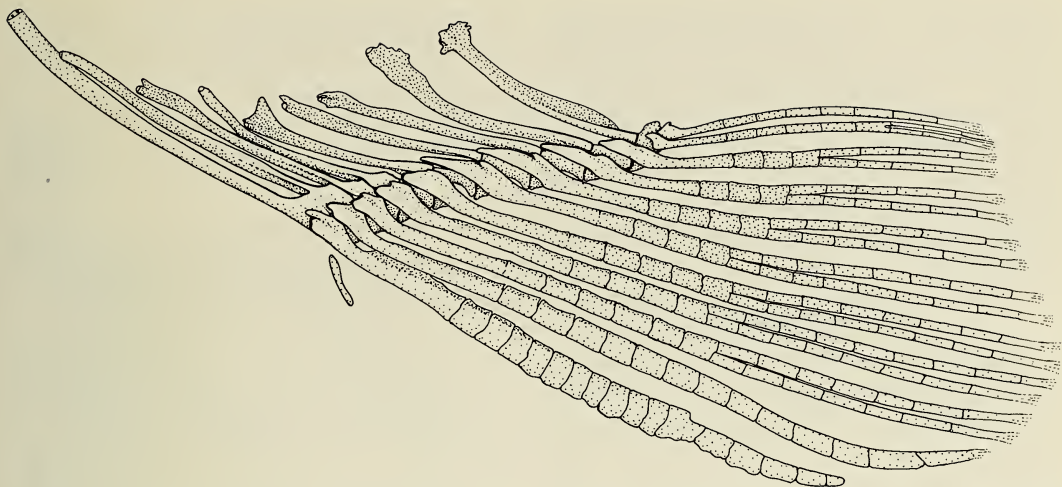


Fig. 7. *Nannostomus anduzei*, new species, paratype, USNM 277695, male SL 14.5 mm. Lateral view, left side of skeleton of anal fin. Anterior two fin rays somewhat thickened.

similar to some other small species of *Nannostomus* in having shared, apparently progenic, characters such as reduced laterosensory head canals, but the phylogenetic significance of these modifications are not understood. These reductions could be phylogenetically shared or independently derived. See comments by Weitzman and Fink (1983:345–346), Weitzman and Fink (1985: 9–10, 65–69) and Weitzman and Vari (in press) for discussion of similar problems in other small to miniature characiforms. Unfortunately, the reductive characters are not corroborated by non-reductive synapomorphies such as the various derived aspects of the color pattern or anal-fin specializations. We cannot place this species as a sister species to any other species of *Nannostomus*.

Ecological notes.—All specimens were taken at nearly the same locality, near the small community of Provincial. The water is clear, not black, in an area dominated by small blackwater streams and ponds. Caño Provincial is a permanent forest stream with mostly a slight current. It originates from a small spring surrounded by a plant community principally consisting of the palm *Mauritia flexuosa*. The water is transparent, shallow, to about one-half meter in depth.

The temperature is about 27° Celcius depending on where it is taken, and with a pH of about 5.0. The bottom is principally white sand, roots, and fallen leaves. Laguna Provincial occurs about two kilometers downstream where Caño Provincial opens into a wide shallow lagoon in a flat savanna area next to the Rio Orinoco. The lagoon is often warmer than the caño, about 30° Celcius, often turbid and its pH varies from that of the caño to about neutral. The bottom of the laguna is of mud and floating and emergent vegetation is common. *Nannostomus anduzei* is confined to the caño or areas in the lagoon influenced by the caño. It occurs in areas of slow current among aquatic plants. The fish is not found in black waters and appears confined to the Caño and Laguna Provincial.

Etymology.—The name *anduzei* is for Dr. Pablo Anduze, a Venezuelan scientist and explorer who has provided much help to the senior author in her work on the fishes of the Territorio Federal de Amazonas.

Resumen.—*Nannostomus anduzei* es descrito como una nueva especie de pez caraciforme de la Familia Lebiasinidae. Esta especie proviene de la Laguna Provincial, una localidad cerca del río Orinoco al Norte de Puerto Ayacucho, Territorio Federal

Amazonas, Venezuela. *Nannostomus anduzei* puede ser distinguida del resto de las especies del género por su pequeño tamaño cuando adulto, numerosas estructuras reducidas y patión de coloración particular. Aunque la nueva especie aca descrita es claramente una especie del género *Nannostomus*, su relación con otras especies es oscura.

Acknowledgments

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- (JMF) Estacion Experimental Amazonas Puerto Ayacucho, Ministerio de Agricultura y Cira, FONA, IAP, Puerto Ayacucho, T.F. Amazonas, Venezuela; (SHW) Department of Vertebrate Zoology (Fishes), National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.